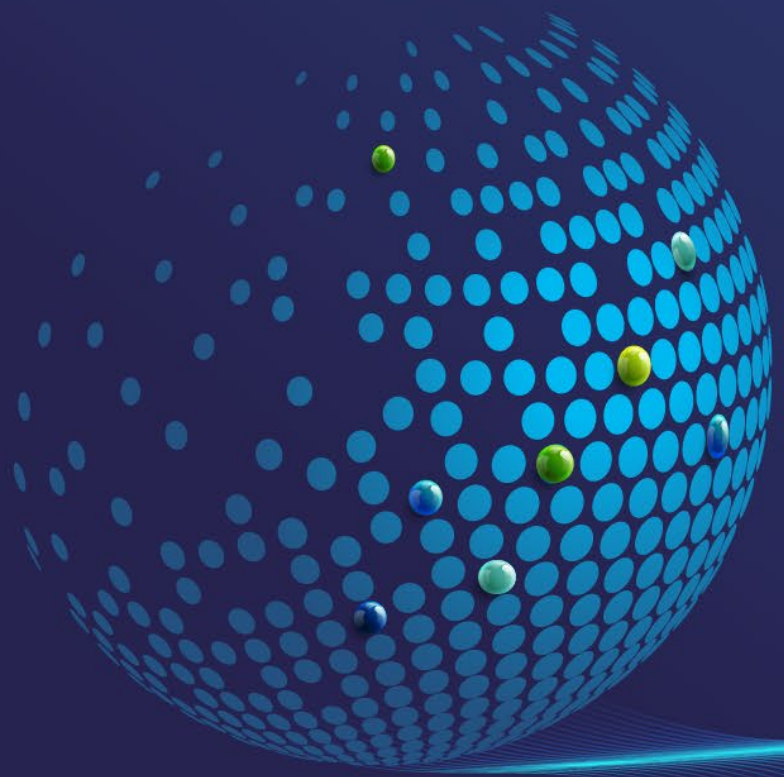

Research on navigation and surveillance – increasing flexibility and resilience of air traffic management

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SESAR 2020 SHOWCASE

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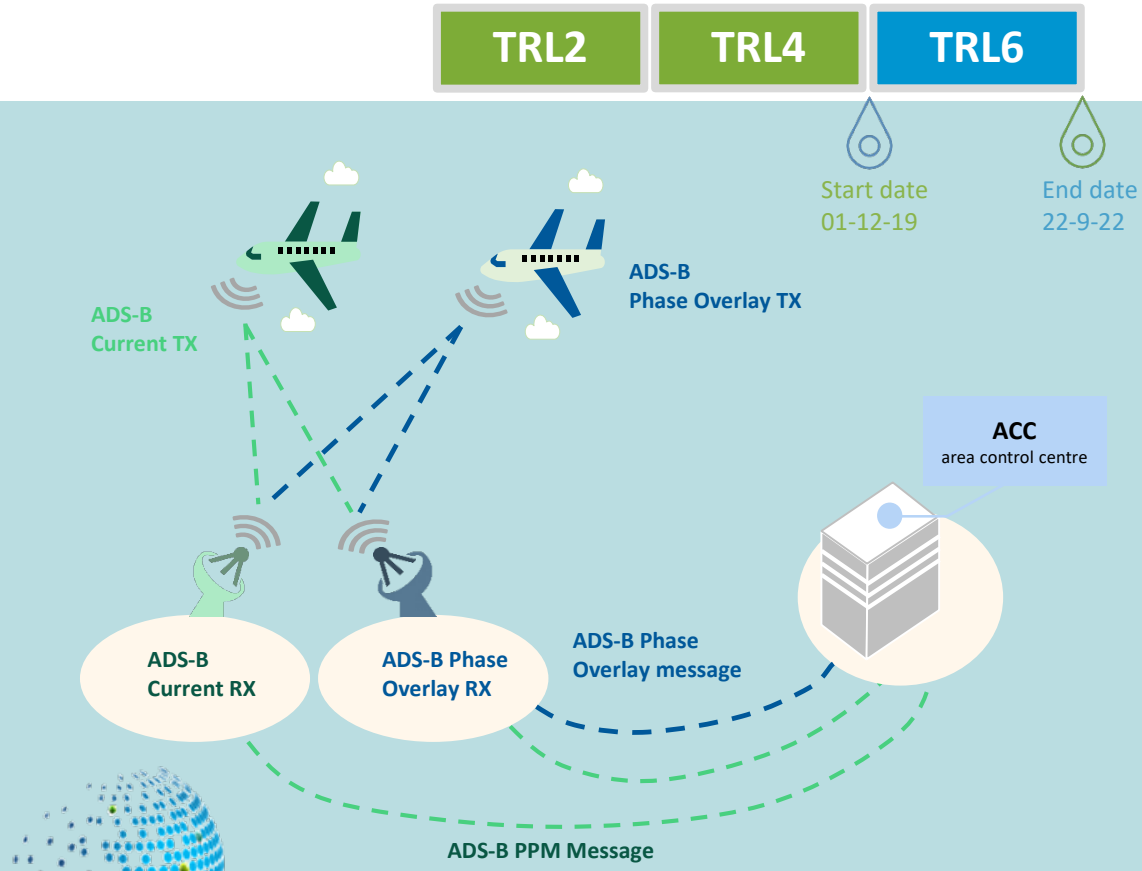

SUR technological partner	ANSP
indra THALES	ENAIRE

PJ.14-W2-84d is a **technological solution validating new ADS-B communication link, Phase Overlay**, enabling the transmission of extra information, complementing the current ADS-B PPM with an 8PSK phase modulation.

Solution follows the specifications of **RTCA and EUROCAE Standard** published documents: **DO260C/ED-102B**.

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PJ.14-W2-84d – Phase Overlay for ADS-B

In order to achieve TRL6, two validation exercises:

- Laboratory
- Real environment

In these exercises objectives were reached:

- Integration btw. transmitter and receiver
- Interoperability with legacy ADS-B
- Physical features of the new modulation
- Transmission of new information types

PJ.14-W2-84d – Phase Overlay for ADS-B

Participants

ENAIRE

indra

THALES

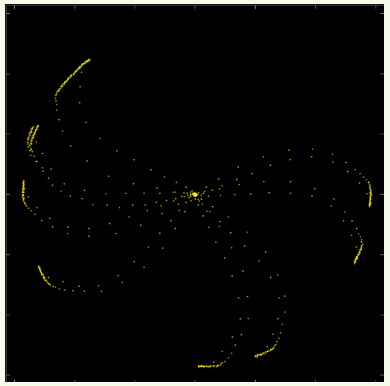
Date & Site

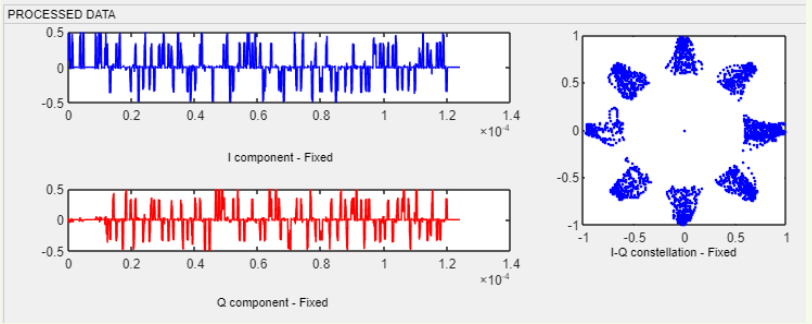
Oct – Dec 2021

Torrejón de Ardoz (Spain)

Objective

Verification of Phase Overlay for TRL6 at laboratory level





IQ diagram of Phase Overlay squitter example

Participants

indra

THALES

Date & Site

Jan 2022

Bordeaux (France)

Objective

Verification of Phase Overlay for TRL6 at real environment

Air Segment

Ground Segment

PJ.14-W2-84d – Phase Overlay for ADS-B

Participants

indra THALES

Date & Site
Jan 2022

Bordeaux (France)

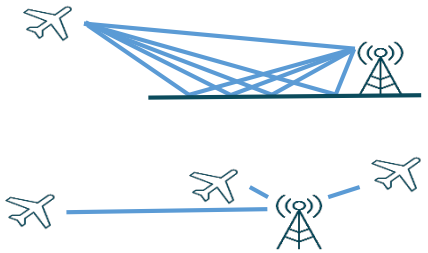
Objective
Verification of Phase Overlay for TRL6 at real environment

Air Segment

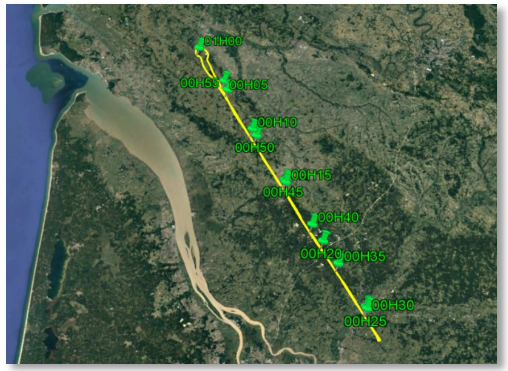
Ground Segment

Flight plan for multipath

- Multipath



- Range and altitude



Flight plan for range & altitude

PJ.14-W2-84d – Phase Overlay for ADS-B

Conclusions and Recommendations

High-level Benefits

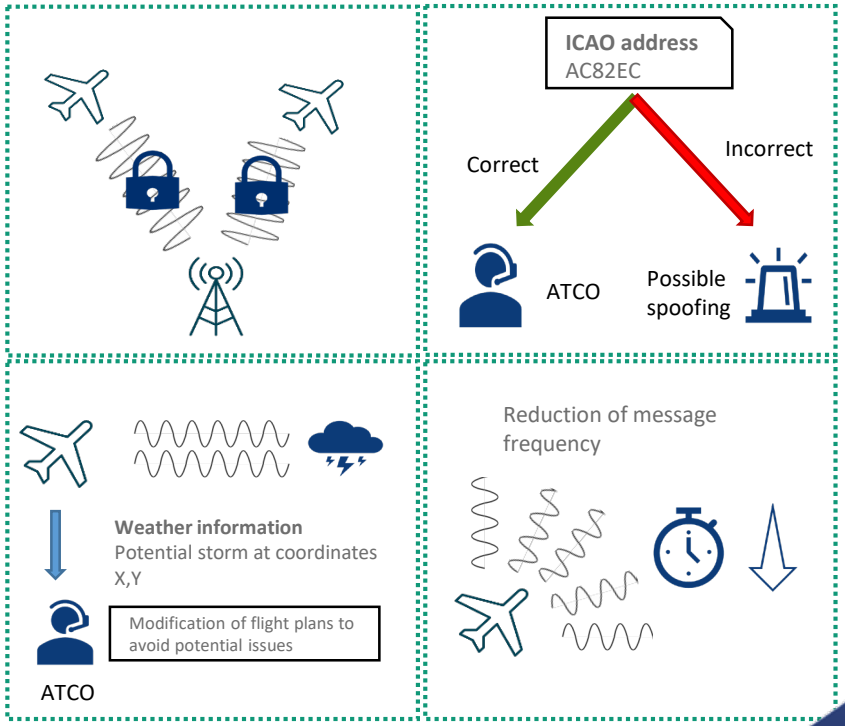
1. Message Capacity
2. ADS-B Security
3. Spectrum efficiency

Conclusions

Phase Overlay technology has demonstrated to be mature enough to achieve TRL6.

Recommendations

- Update ED-102B/DO-260C standards with the results obtained
- Creation of new SESAR solutions to study the potential operational applications of Phase Overlay (cybersecurity, authentication, new data…)



PJ.14-W2-79a/b – GAST-D/F

Activities

- Extending GAST D to adverse ionosphere conditions (ionosphere gradients and scintillation conditions).
- Extending GAST D to complex environments (VDB coverage at complex airport, handling RFI/jamming): Perform statistical analysis of the captured RFI events. Analyze in terms of probability of occurrence, occurrence rate on the L1 frequency only, L5 frequency only as well as L1 and L5 frequency bands together.
- Discussion of DFMC GBAS concept at international level (ICAO/EUROCAE/RTCA).
- DFMC GBAS degraded modes in case of RF Interferences or adverse ionosphere conditions.
- Execution of validation exercises at Tenerife Norte and Barcelona airports.

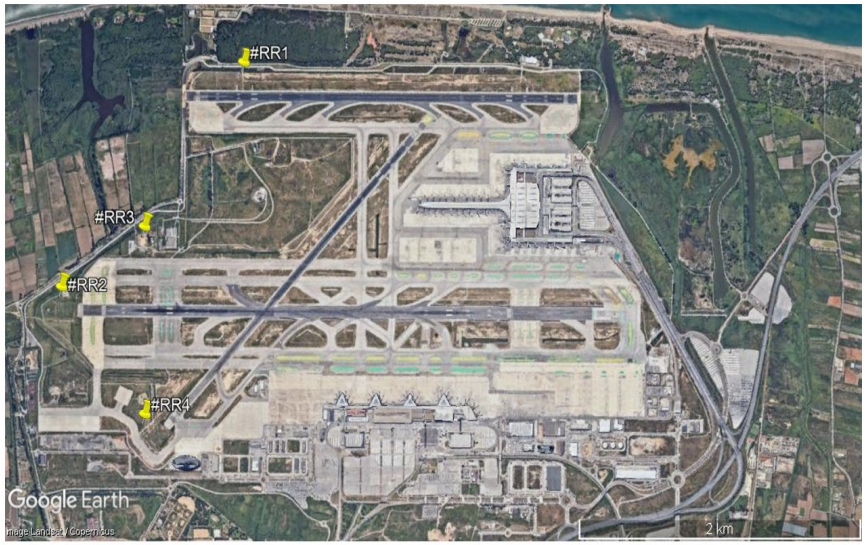


Figure 18: GAST F GBAS Reference Receivers at Barcelona airport.

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PJ.14-W2-79a/b – GAST-D/F

Validation Results

- It is possible to operate GAST D in the equatorial regions.
- Scintillation noise can affect several integrity monitors.
- The validation exercise to measure VDB field strength with an accuracy as recommended by ICAO Doc 8071 Vol II (± 3dB) proved difficult to achieve.
- RFI affects all GNSS bands but L1/E1 is the most exposed.
- Good accuracy results obtained in the GAST F L5/E5a only mode.
- GAST F DFMC Iono gradient monitor was validated in several airports.

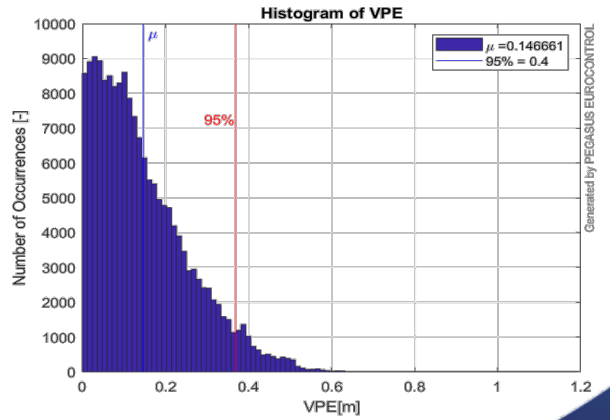

Figure 19: VPE in L5/E5a only mode

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Thank you for your attention

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